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Dynamic Shortest Path Problem with Stochastic Disruptions

Abstract

In traffic networks, link disruptions due to accidents, bad weather and traffic congestion lead to a significant increase in travel times and decrease the probability of being on-time at the final destination. In practice, navigation technologies (like TomTom Route Planner) currently respond to these disruptions by using offline information (i.e. historical data giving information on the expected state of the network) and/or online information (i.e. information on the actual real-time state of the network) to create paths that are less affected. As such, using more information enables to generate better solutions for navigation systems. However, this information does not come free since this may need longer routing calculation times and higher information retrieval costs. Therefore, it is essential to use routing policies that effectively respond to the network disruptions and give a high quality of solutions within acceptable calculation times. In this research, we consider dynamic shortest path problems with disruptions on certain arcs. We model the problem as a discrete time, finite horizon Markov Decision Process. We develop computation-time-efficient routing policies where we use different levels of information at different parts of the network. We also investigate the effect of having more online/offline information at different parts of the network on the solution quality and calculation times. We develop a test bed of networks to evaluate the efficiency of the policies.

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